Case Report Rapport de cas

Severe anemia associated with *Mycoplasma wenyonii* infection in a mature cow

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Abstract — The clinical findings, diagnostic tests, and treatment of clinical anemia in a mature Angus cow infected with the hemoplasma *Mycoplasma wenyonii* are described. *Mycoplasma wenyonii* has been previously reported to cause clinical anemia in young or splenectomized cattle; however, infection has not been associated with severe anemia in mature animals.

Résumé — Anémie grave associée à une infection par *Mycoplasma wenyonii* chez une vache adulte. Les constatations cliniques, les tests diagnostiques et le traitement de l'anémie clinique chez une vache Angus adulte infectée par l'hémoplasme *Mycoplasma wenyonii* sont décrits. Il a déjà été signalé que *Mycoplasma wenyonii* a causé une anémie clinique chez les jeunes bovins splénectomisés; cependant, l'infection n'a pas été associée à une anémie grave chez les animaux adultes.

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Mycoplasma wenyonii, formerly known as *Eperythrozoon wenyonii,* is an epicellular hemotropic mycoplasma that is found attached to red blood cells or free in the plasma of infected cattle (1). It can be found in ring, rod, or cocci forms during cytologic examination of blood smears stained with Romanowski staining methods. *Mycoplasma wenyonii* is most commonly found in young, splenectomized, or immuncompromised cattle, but rarely causes clinical disease severe enough to require treatment. Clinical signs seen in cattle infected with *M. wenyonii* include anemia, ill-thrift, fever, lymphadenopathy, depression, diarrhea, decreased milk production, pyrexia, infertility, scrotal and hind limb edema, swollen teats, weight loss, and reproductive inefficiency (2–4). *Mycoplasma wenyonii* is treated with tetracycline antibiotics.

Case description

A 10-year-old, 488-kg commercial Angus cow was presented on emergency to the Oklahoma State University Boren Veterinary Medical Teaching Hospital (BVMTH) with a 1-week history of lethargy, decreased appetite, coughing, weight loss, swelling of the hind limbs, and complete anorexia of 24 h duration. The cow had developed lethargy over the preceding week, began segregating herself from the herd and had lost approximately 45 kg over the previous 1 to 2 wk. In addition, the cow had a 4-month-old bull calf at her side to be marketed as a steer. No other animals in the herd were reported to be affected.

On physical examination, the animal was febrile [39.8°C; reference interval (RI): 38°C to 39°C], tachycardic (92 beats/min; RI: 60 to 80 beats/min), and tachypneic (36 breaths/min; RI: 10 to 30 breaths/min) with a body condition score of 2.5/9. The cow was mildly depressed and oral and vulvar mucous membranes were pale. There were no abnormalities on thoracic auscultation. The animal's breath was malodorous and fetid, but oral and pharyngeal examination did not reveal any cause for the odor. No nasal discharge was observed. Rumen contractions were of normal frequency and strength. Rectal palpation revealed loose feces and no palpable pregnancy. The cow appeared to be in pain and stiff on its hind limbs and dragged the hooves during ambulation. The cow's lameness was graded 2/5 (5). The hind limbs were painful to palpation, slightly warm and edematous from the hock to the coronary band. Packed cell volume was 15% (RI, 30% to 46%). Fecal occult blood and fecal flotation were negative and urine dipstick analysis was unremarkable. The cow appeared clinically stable, and further diagnostic workup was delayed until normal hours of operation.

The following day, the cow's mentation and temperature, heart rate and respiratory rate were similar to initial presentation. The cow had developed serous nasal discharge overnight. Rumen contractions were decreased in number (1 per 2 min; RI 3 per 2 min) and strength. The cow had eaten a small amount of alfalfa hay overnight. The hind limb edema and lameness were unchanged. Differential diagnosis for the major problems of weight

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loss, pyrexia, anemia, lameness, and hindlimb edema included *Mycoplasma (Eperythrozoon) wenyonii* and bacterial endocarditis or other chronic suppurative processes with concurrent septic polyarthritis.

Ultrasound examination of the thorax revealed bilateral pleural thickening of the cranioventral lungs. The left cranioventral lung had changes consistent with pulmonary consolidation and abscessation. These findings were indicative of chronic bacterial pneumonia. Abdominal ultrasound was unremarkable. Ultrasound examination of the tarsi revealed a moderate increase in hypoechoic fluid with a few scattered hyperechoic areas free floating in the synovial fluid. Arthrocentesis and analysis of synovial fluid from the right hock revealed an increased protein (37 g/L; RI: 12 to 18 g/L) and increased cell count with 8900 nucleated cells/μL (normal < 500 cells/μL) and 1.2×10^6 red blood cells/μL. Cytologic examination revealed 95% non-degenerate neutrophils, 5% macrophages, and a few scattered red blood cells. Infectious organisms were not seen. The cytologic findings were consistent with suppurative inflammation and thus synovial fluid was submitted for culture which revealed a trace number of *Corynebacterium* spp.

Hematologic findings revealed a regenerative anemia (hematocrit 13%; RI: 30% to 46%) with marked anisocytosis, moderate polychromasia, and occasional basophilic stippling. Large numbers of small (0.5 to 1.0 μm) parasites were observed in Wright's stained blood smears that were rod, ring, and coccoid shapes, consistent with the morphology of *Mycoplasma wenyonii.* The organisms, seen on the surface of erythrocytes or free in the serum, occured as single organisms or in short chains. A lymphopenia (336/μL; RI: 2500 to 7500/μL) and monocytosis (1344/μL; RI: 25 to 840/μL) were also present. The plasma protein was within normal limits (61 g/L; RI: 55 to 79 g/L) though there was a marked increase in fibrinogen concentration (29.4 μmol/L; RI: 5.9 to 14.7 μmol/L). These changes were considered to be consistent with inflammation and stress.

Serum biochemistry revealed a mildly decreased magnesium concentration (1.0 mmol/L; RI: 1.1 to 17 mmol/L), elevation in lactate dehydrogenase (LDH) (2300 IU/L; RI: 310 to 750 IU/L), decreased creatine phosphokinase (CPK) (42 IU/L; RI: 50 to 315 IU/L), and a profound hypoglycemia (0.55 mmol/L; RI: 2.8 to 5.0 mmol/L). The mild decrease in magnesium could be attributed to decreased dietary intake as indicated by the history of anorexia. The elevation in LDH was attributed to hemolysis that resulted from the *M. wenyonii* infection detected by microscopic examination. The increased LDH values were not likely due to muscle damage or liver dysfunction because there were no concurrent increases in other enzymes associated with those disease processes. The decrease in CPK and glucose were attributed to a 4-hour delay in delivering the sample to the laboratory. The profound hypoglycemia was likely multifactorial. In vitro glycolysis by blood cells, which can cause a 10% reduction per hour at room temperature (6), and presumed glucose utilization by *M. wenyonii* most likely contributed to a post-collection decrease in glucose concentration. Clinically, the animal appeared to be stable and therefore was not treated for the hypoglycemia.

Based on these findings, the cow was diagnosed with a primary chronic bacterial pneumonia. Secondary infection with *M. wenyonii* was deemed responsible for the anemia, arthropathy, and hind-limb edema. Treatment was initiated with oxytetracycline [200 mg/mL, 20 mg/kg body weight (BW), SC, q72h] (Liquamycin LA-200; Pfizer Animal Health; New York, New York, USA). Flunixin meglumine (1.1 mg/kg, IV PRN temperature > 40.3°C) (Banamine; Intervet/Schering-Plough Animal Health, Union, New Jersey, USA) was given for its antipyretic and anti-inflammatory properties. Packed cell volume, total plasma protein, blood glucose, and blood smears were monitored daily. Plasma protein remained relatively steady with values from 0.05 to 0.06 g/L. Blood glucose was monitored daily with a portable handheld analyzer (Ascensia ELITE® XL; Bayer Corporation, Tarrytown, New York, USA) and remained slightly decreased to low normal (2.7 to 3.2 mmol/L; RI: 2.8 to 5.0 mmol/L) throughout treatment. The PCV increased daily after initiation of antibiotic therapy from 13% on day 2 to 28% on day 8. Microscopic evaluation of serial Wright's stained blood films revealed a progressive daily decrease in parasitemia from an initial estimate of 57% affected red blood cells (based on a 1000 erythrocyte count) with numerous organisms free in the background, to a final estimated parasitemia of 5% affected red cells without free organisms noted in the background by the 7th day of treatment.

The animal improved clinically with treatment, though her respiratory rate remained elevated throughout hospitalization (40 to 80 breaths/min). Thoracic auscultation was unremarkable for the duration of hospitalization. The cow's appetite improved dramatically and she became mentally brighter and spent more time standing. The lameness, hind-limb edema, and tarsal joint effusion decreased in severity daily and were resolved by day 4 of hospitalization.

On day 8, increased respiratory rate and increased dyspnea were observed. Due to the chronic pneumonia, economic considerations and concerns about potential long-term carrier status of *M. wenyonii,* the animal was humanely euthanized after which necropsy was performed following standard protocols.

At necropsy, a chronic cranioventral lobar pneumonia was detected. Gross section of the lungs revealed purulent debris within airways. Scattered pleural thickening and pleural adhesions to the thoracic wall were observed. A few scattered abscesses were within the cranioventral lung parenchyma. A single focus of adventitial hemorrhage was seen at the base of the aorta. Lung culture was negative, possibly attributable to recent antibiotic administration. Histologic assessment of the gross lesions confirmed the gross findings.

Discussion

Mycoplasma wenyonii was determined to be the cause of the anemia in this animal based upon history, clinical findings, response to treatment, and necropsy findings. *Mycoplasma wenyonii* is common in cattle worldwide. Formerly known as *Eperythrozoon wenyonii,* it has been recently been reclassified to the *Mycoplasma* genus based on analysis of the 16S rRNA (7). *Mycoplasma wenyonii* is an epicellular prokaryote found in cocci, ring, and rod shapes that parasitizes red blood cells of cattle (1). The organisms have a single-cell membrane and adhere to the red blood cell membrane, but are not intraerythrocytic (1).

Infection is most often subclinical and the incubation period is not predictable unless the animal is splenectomized or otherwise immunocompromised. *Mycoplasma wenyonii* is routinely seen on blood smears from experimental cattle that have been splenectomized, but the infection rarely causes clinical signs. Heavy burdens with *Mycoplasma wenyonii* are commonly seen immediately preceding the appearance of *Anaplasma marginale* infections in splenectomized calves that have been experimentally infected with *A. marginale* (Kocan, unpublished data).

A cell culture has not been developed for *M. wenyonii;* this has limited research into the transmission and life-cycle of the organism. The mode of transmission of *M. wenyonii* is currently unknown, but most likely results from mechanical transmission by blood-sucking arthropods, direct contact, and iatrogenic transmission (2). The majority of cattle infected with *M. wenyonii* do not develop clinical signs: clinical illness is rare and seen only when concurrent illness results in immunosupression. Most often when clinical signs do occur, heavy infections are transient and more likely to be seen in splenectomized calves. Clinical signs associated with infection include anemia, ill-thrift, fever, lymphadenopathy, depression, diarrhea, and decreased milk production (2). Pyrexia, infertility, and scrotal and hind-limb edema were reported in a 16-month old bull (3). In post-parturient dairy heifers in Colorado, *M. wenyonii* has been associated with swollen teats, edema of the distal hind limbs, prefemoral lymphadenopathy, transient fever, rough coat, decreased milk production, weight loss, and reproductive inefficiency (4). Severe clinical anemia is most often reported in young animals and those that have been splenectomized. Icterus and hemoglobinuria have been reported, but are not consistently encountered. Infection causes a profound hypoglycemia in numerous species, including pigs, camelids, lambs, and calves (8–12). Life-threatening hypoglycemia may be due to glucose metabolism by the parasite exceeding the animal's gluconeogenic capacity. A short delay in laboratory analysis resulted in falsely decreased blood glucose concentrations in a lamb with a large parasite load of *Mycoplasma ovis* (8).

Anemia of chronic inflammation or disease was ruled out in this mature cow as it is most commonly non-regenerative and mild to moderate in severity. In this animal, the anemia was severe, regenerative, and responded to treatment with tetracycline antibiotics and therefore attributed to infection with *M. wenyonii.*

The severe *M. wenyonii* parasitemia and resultant clinical anemia in this case are believed to have been due to immunosuppression secondary to chronic pneumonia. Additional diagnostics to better characterize the pneumonia, such as transtracheal wash and thoracic radiographs, and to guide treatment decisions were warranted. However, this was a commercial cow; economic considerations precluded further diagnostics and dictated the use of inexpensive antimicrobials. A rebreathing examination was not performed, though it would have increased the likelihood of auscultation of abnormal lung sounds.

Due to the resolution of the joint effusion and lameness, it was suspected that the change seen on cytology of the synovial fluid was non-septic and that the trace numbers of bacteria cultured were due to contamination of the sample. It is also suspected that the increased numbers of white blood cells seen on analysis of the synovial fluid were in part due to blood contamination as evidenced by the high red blood cell count. Non-septic suppurative inflammation can be seen with chemical injury, trauma, immune-mediated disease, and rickettsial, viral, and fungal agents. Cattle with noninfectious arthritis, such as immune-mediated arthropathies, have been reported to commonly have total protein concentrations < 45 g/L (12). In a case report of *M. wenyonii* in a bull with scrotal edema, skin biopsies revealed changes consistent with an Arthus-type reaction (3) and an immune-mediated vasculitis has been reported to play a role in the formation of hind-limb edema (4). Thus, it is likely that the joint effusion observed in this cow was primarily due to an immune-mediated process with deposition of immune complexes followed by vasculitis and edema formation and not due to the cultured bacteria.

There are multiple causes for anemia with concurrent edema in adult cattle. Regional edema localized to the hind limbs is much less common, but can be seen with lymphatic disorders such as lymphosarcoma, phycomycosis, and ulcerative lymphangitis and vascular disorders such as peripheral venous occlusion and vasculitis. Clinical and postmortem examination did not reveal evidence of localized or generalized lymphatic or cardiovascular disorders. The lack of histologic examination of the joints and skin of the distal hind limbs precludes documentation of a vasculitis, but severe *M. wenyonii* parasitemia, the response to therapy and the clinicopathologic findings support the diagnosis of *M. wenyonii* as the cause of the anemia, lameness, and hind-limb edema in this cow.

Treatment for hemotropic mycoplasmas includes the use of tetracycline antibiotics for extended periods for reduction of the pathogen load and the clinical signs. No antibiotic protocol has been proven to eliminate infection and infected animals are thought to remain carriers for life. To our knowledge, this appears to be the first reported case of severe clinical anemia associated with *M. wenyonii* in a mature bovine.

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Book Review
Compte rendu de livre

Urological Disorders of the Dog & Cat

Holt P. Manson Publishing, London, 2008. ISBN 9781-8407-6095-8, 176 pp.

Urology is rarely covered as a stand-alone topic in veterinary medicine. This book covers both diagnostics as well as therapeutics. Given that Dr. Holt is a surgeon, the book is heavily skewed towards surgical interventions. The initial part of the book covers diagnostic procedures in very good detail. The description of contrast studies is very practical and would be useful to anyone considering a procedure such as intravenous urography or a cysto-urethrogram. Some of the procedures are very basic such as urethral catheterization; this will appeal less to the practicing veterinarian and more to students or veterinarians at the beginning of their career. The diagnostic section is certainly complete and gives very good tips for all levels of training.

The treatment and disease section is divided up into sections on non-prostatic dysuria, prostatic disorders, urinary tract trauma, other causes of hematuria and urinary incontinence. Images and diagrams in this section are used to show common disorders and a wide variety of surgical procedures. Some of the surgical procedures covered include cystotomy, perineal urethrostomy, perineal hernia, tube cystotomy, and nephrotomy.

Overall this is a well-illustrated guide to urology in dogs and cats. It will be very useful to practicing veterinarians, especially those that are more surgically inclined. The book isn't set up to be read cover to cover, which the author states in the foreword, though I believe the diagnostic section would be suitable for this. The disease and treatment section is set up to be used as a quick reference when you are dealing with a problem and looking for possible therapeutic options.

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